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red, while in September, the displacement was 0.3 A toward the red. There is no obvious explanation for these anomalous displacements.

It is desirable that the visual and the ultra-violet spectra of *o Ceti* be studied at future maxima to determine in how far the behavior of the absorption bands and especially of the bright hydrogen lines, as observed in 1919, is repeated.

C. D. SHANE.

SUMMARY OF MOUNT WILSON MAGNETIC OBSERVATIONS OF SUN-SPOTS FOR MAY AND JUNE, 1920

Observations of the magnetic field in sun-spots were first made at Mount Wilson Observatory in 1908[1]. In the beginning only large spots could be observed, but as the methods and instruments were perfected it became possible to detect the polarity of very small spots. Since 1915 daily visual observations have been made of the magnetic field of all sun-spots for which such observations were possible.

The polarity can be determined when the line of sight is not too greatly inclined to the lines of magnetic force, which are perpendicular to the Sun's surface at the center of a spot. Near the Sun's limb polarity determinations are difficult for large spots, and impossible for small ones. The observations are made in the second order of the 75-foot spectrograph of the 150-foot tower telescope, usually with the iron line at λ6173.553. The method of observation and the scheme of classification according to polarity are described in detail, with illustrations, in the *Astrophysical Journal* for April, 1919, and in *Mount Wilson Contributions* No. 165.

The image of the Sun, 42.4 cm. in diameter, is projected upon a sheet of paper and a sketch of the spots is made. The approximate heliographic latitude and longitude of each group is read from a disk upon which the meridians and parallels of latitude have been drawn. The magnetic polarity and field-strength of each spot are then determined by the character of the polarization and the measured separation of the components of a Zeeman triplet.

These magnetic observations will be published in detail, probably in graphical form, but even after a complete scheme of periodical publication has been established, the installments will necessarily be some months late. Meanwhile it seems desirable to print regularly a summary, showing the polarity classification of all sun-spots observed here.

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[1] Hale, *Mount Wilson Contributions*, No. 30, *Astrophysical Journal*, **28**, 315, 1908.

For our own convenience a serial number has been given to each group (col. 1 of the accompanying tables). There is no intention of using this designation in preference to the Greenwich number; in fact, in our own records the Greenwich numbers are adopted as soon as available. In the past few years, however, because of war conditions, the Greenwich numbers have been published very irregularly, and none have appeared since January 1917. Not every Greenwich group has been observed here; also there may be a difference in defining the groups, since at Mount Wilson the polarities of the spots are considered in assigning numbers, so that in some cases two Greenwich groups have been given one number, or vice versa. The last published Greenwich number, No. 7930, was No. 511 at Mount Wilson.

In order to make identification possible, the Greenwich mean time of central meridian passage and the heliographic latitude are given for each group in the second and third columns of the tables. These positions are approximate and may differ somewhat from the measured values obtained at Greenwich. Column 4 gives the maximum field-strength, H, observed in each group, expressed in units of 100 gausses.

The spot groups are divided into three classes, which are designated here as *unipolar*, *bipolar*, and *complex*.

The *unipolar* groups are single spots or groups of spots having the same magnetic polarity. This class is subdivided, according to the position of the group in the surrounding calcium flocculi, as follows:

(α) Those for which the distribution of calcium flocculi is fairly symmetrical preceding and following the group.

(αp) Those which are in the preceding part of the surrounding calcium flocculi.

(αf) Those which are in the following part of the surrounding calcium flocculi.

The simplest *bipolar* group consists of two spots of opposite polarities, the line joining them generally making a small angle with the solar equator. Usually, however, the *bipolar* group is a stream of spots, those in the preceding and following parts of the group being of opposite polarity. Generally the change in polarity is near the center of the stream, but it may be on either side of the center. The *bipolar* groups are subdivided, according to the area and distribution of the different magnetic fields, as follows:

(β) Those in which the leading and following members, whether single or multiple, are approximately equal in area.

(βp) Those in which the leading members are the principal components of the group.

(βf) Those in which the following members are the principal components of the group.

($\beta\gamma$) Those in which the bipolar characteristics are shown, but in which there is no marked dividing line between the spots of different polarities. This includes cases where the preceding or following members are accompanied by companions of opposite polarity.

The *complex* groups (γ) are those in which spots of both polarities are so irregularly distributed as to prevent classification as *bipolar* groups. The class is small but contains many of the large very active groups. It should be noted, however, that unipolar spots and the chief components of bipolar groups may occasionally have small companions of opposite polarity, which play such a minor and sporadic part in the group that they are disregarded in the classification.

In the tabulation of the polarities an x indicates that the group was photographed or seen on that date, but that no polarity observation was made of it. The direct photographs made at the 60-foot tower telescope are available for these additional data. At the foot of each column is given the number of groups observed that day. When the column for any day is blank, and a dash is used instead of the number of groups, it indicates that no observations were made on that date. If the Sun was observed but no spots were visible, a zero will be found at the foot of the daily column.

Since the minimum of 1913, unipolar groups and the preceding spots of bipolar groups in the northern hemisphere have had a polarity like that of a north-seeking pole, called positive in this summary. In the southern hemisphere similar spots are of opposite polarity, and are called negative. There are very few exceptions to this rule, and unless the contrary is noted it is to be understood that the group is "regular" in polarity.

MAGNETIC CLASSIFICATION OF SUN-SPOTS FOR MAY, 1920.

No.	C. M. P.	Lat.	H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1671	April 30.9	+11	27	α				α	α										
1673	27.0	+ 5	10	β															
1675	May 5.4	+14	8	β															
1676	7.5	− 4	7					α	α	α	α	α							
1677	8.8	− 7	23					βp	βp	βp	αp	βp	αp	αp	αp	x	x		
1678	3.0	+15	3						β										
1679	8.2	− 4	19							β	βf	βf	βf	αf					
1680	13.4	− 6	16							x	α	α	α	α	α	x	α	x	
1681	14.8	+18	16									x	βp	βp	βp	x	βp	x	
1682	9.7	−17	5										β						
1683	8.8	+14	22														αp		
1684	14.0	−13	—														x	x	
				3	—	—	—	3	4	4	4	5	5	4	3	3	5	3	—

No.	C. M. P.	Lat.	H	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1680	May 13.4	− 6	16	x															
1681	14.8	+18	16	x			βp												
1685	22.6	+23	10	x	βp	β	β	β		βp	αp								
1686	27.4	+ 8	29							α	αp	βp	βp	βp	βp	αp	αp	βp	αp
1687	27.8	− 8	10										β	αp	βf				
1688	23.3	+ 4	12											βf	βf				
1689	31.6	+14	16											x	βp	βp	βp	βp	βp
1690	25.2	−12	8													β	β	β	x
1691	25.9	+ 5	12															αp	Bf
1692	June 4.5	+15	31															x	βp
1693	May 29.9	+12	3																α
1694	30.9	+16	12																αp
				3	1	1	2	1	—	2	2	1	2	4	4	3	3	5	7

NOTES.

No. 1671 Return or revival of 1665.

No. 1680 Return of 1669. This is the last appearance of the great group of March 21.

No. 1686 This group on some days consisted of several spots in stream formation but all were of the same polarity. On one day a small spot of opposite polarity followed.

No. 1692 Return of 1683.

MAGNETIC CLASSIFICATION OF SUN-SPOTS FOR JUNE, 1920.

No.	C. M. P.	Lat.	H	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1686	May 27.4	+8	29	αp	αp													
1689	31.6	+14	16	αp	x													
1691	25.9	+5	12	x														
1692	June 4.5	+15	31	βp	βp	βp	βp	βp	βp	βp	αp	αp	αp					
1694	May 30.9	+16	12	βp	β	βp	βp	αp	x									
1695	June 6.3	−5	14		βp	βp	βp	αp										
1696	May 31.2	+8	8		β	βf												
1697	June 9.4	−12	10					α	α									
1698	11.4	+14	32							βp	βp	βp	βp	βp	βp	βp	βp	
1699	11.7	+22	12								βf	αf						
1700	12.3	+18	19											βp	βf	βf	β	
1701	16.8	+11	—											x	x	x		
1702	14.6	+11	6													βf		
1703	20.5	−9	23														x	
				5	6	4	3	4	3	2	3	3	2	3	3	4	3	—

No.	C. M. P.	Lat.	H	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1698	June 11.4	+14	32	αp	αp													
1700	12.3	+18	19	β	αf													
1703	20.5	−9	23	αp	αp	α	α	αp	αp	αp	αp	αp	αp					
1704	22.7	−8	27		αp	αp	αp	αp	αp	αp	αp	αp	αp	αp	x			
1705	18.4	+8	5					β	β									
1706	23.0	+6	6						αp									
1707	27.0	+15	23						x	γ	βγ	βγ	βγ	βγ	x		βγ	βγ
1708	23.9	−20	19								βp	β	βp	βp	x			
1709	July 1.5	+14	30										x	α	x		α	α
1710	3.4	−14	28														Bp	βp
				3	4	2	2	3	5	3	4	4	5	4	4	—	3	3

NOTES.

No. 1703 Return of 1690.

No. 1707 Return of 1694. No. 1707 was made up of three or four small spots. The polarities of the leading and following spots were both positive, and the main spot, of negative polarity, was between them in longitude and about two degrees north. It had the appearance of a bipolar group, abnormally inclined to the equator, followed by a unipolar spot.